



Armed Forces College of Medicine AFCM



Male Reproductive System (2)

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INTENDED LEARNING OBJECTIVES (ILO)



After studying this lecture, the students should be able to:

- Illustrated the endocrine function of the testes (testosterone, inhibin and testicular secretion of estrogen)
- Describe testosterone actions.
- Describe the processes involved in regulation of testosterone secretion.
- Illustrate the pituitary control of the testicular functions

Function of blood testicular barrier



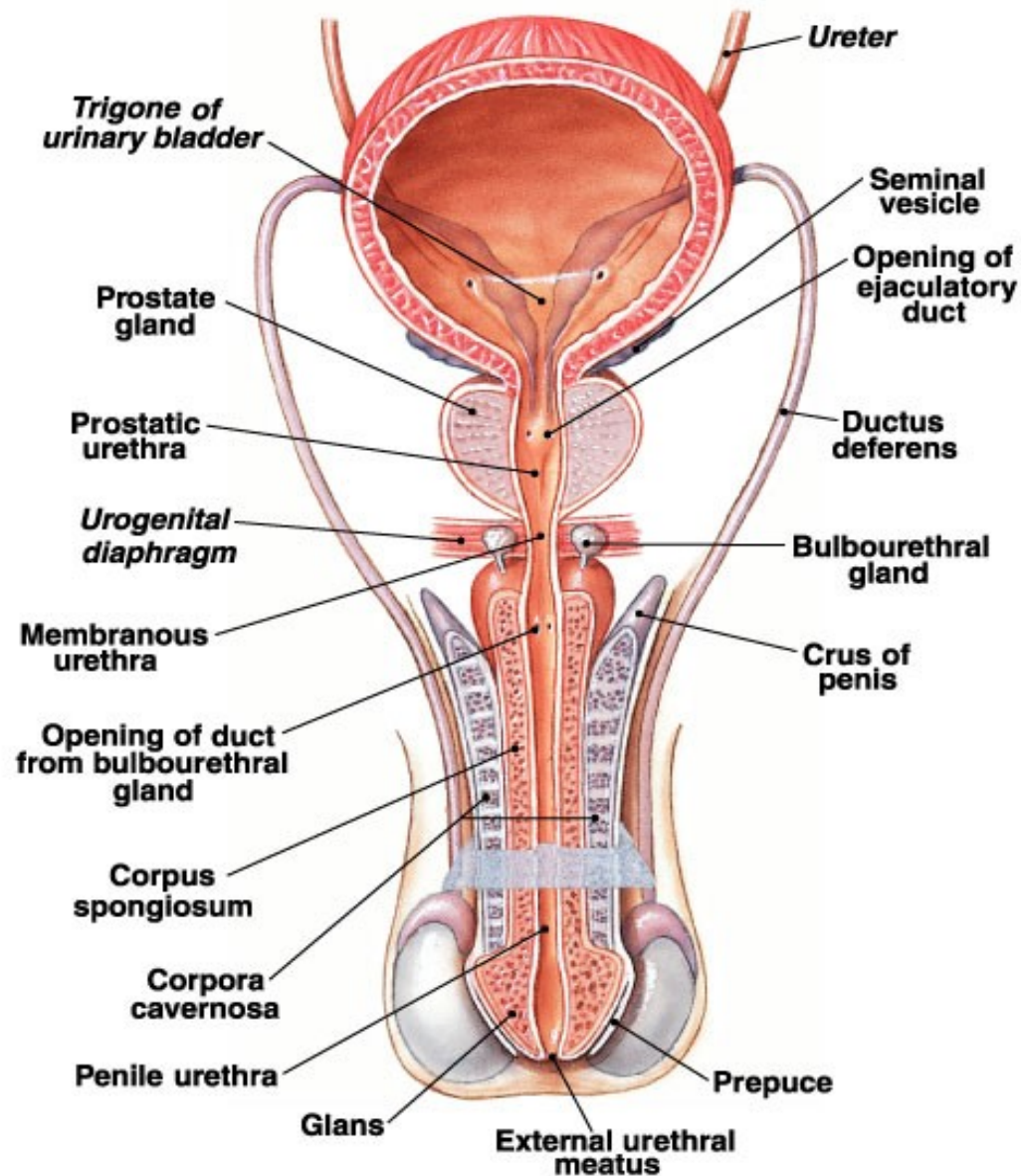
- 1- Blood-borne harmful substances can not pass between to enter lumen of tubule.
 - Only selected molecules (testosterone and estrogen pass through Sertoli cells reach tubular lumen.
 - Tubular fluid is different from the blood i.e. rich in testosterone, estrogen, K^+ and amino acids (aspartic and glutamic acids).
- 2- Prevent immune cells in ECF from entering sperm factory i.e. prevent formation of antibodies against sperms.
- 3- Prevent antigenic products of germ cells from entering blood stream □ prevent formation of Ab

Accessory Sex Glands



Seminal Vesicles

- The **seminal vesicles** are paired glands that produce about 60% of the semen. It helps to dilute sperms to enable them to move.
- **Their secretions contain:**
 - **Fructose** : *energy source for sperm.*
 - **Fibrinogen**: *clotting of semen.*
 - **Prostaglandins**: *react with cervical mucous making it more penetrable by sperms, also stimulate contraction of reproductive tract in both sexes.*



Accessory Sex Glands



Prostate Gland

- It is a single gland, which secretes about **30 % of the semen** .
- *It secretes a milky, slightly alkaline fluid containing proteolytic enzymes and fibrinolysin and PSA.*
- Clotting enzymes in prostatic secretion helps clotting of semen by acting on fibrinogen of seminal vesicle secretion forming fibrin threads

The alkalinity of prostatic secretion neutralize acidity of urethral and vaginal secretion .

- **PSA : PROSTATIC SPECIFIC ANTIGEN** : fibrinolysis dissolves seminal clot releasing mobile sperm in female reproductive tract .

The Bulbourethral Glands

- PSA hydrolyzes (converts fibrinogen to fibrinogenolysin).

are paired glands that secrete **a small amount of thick clear mucus** needed for lubrication prior to ejaculation.

Male Reproductive Ducts

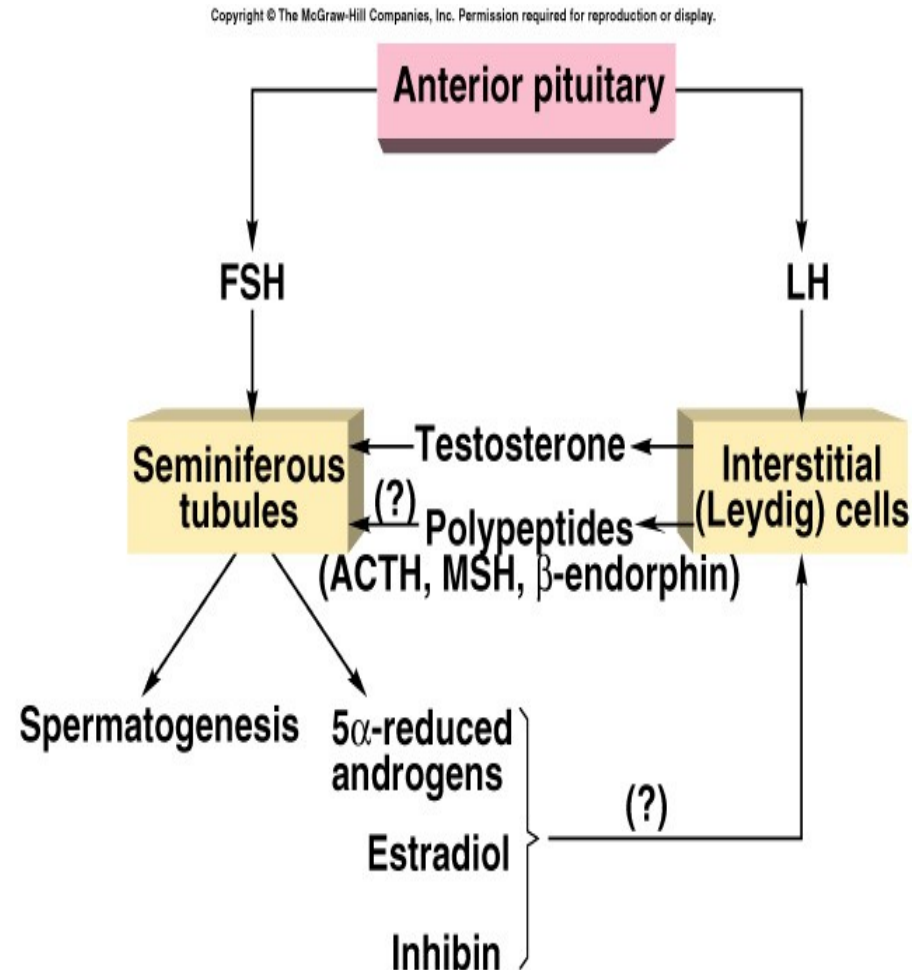


- The spermatozoa traverse the **epididymis** . Through which maturation of sperms take place (motility and capacitation).
- Epididymis stores the sperms which remain viable for several months.
- The sperm migrate into the **duct (or vas deferens)**.
- The vas deferens runs up through the spermatic cord, conducting the sperm to the prostate urethra.

Endocrine Function of the Testes



- Testosterone* and its derivatives:**
- a) Responsible for initiation and maintenance of body changes in puberty.**
 - b) Maturation of accessory sex organs.**



Action of testosterone



I- Before birth:

Differentiation of internal male tract (epididymis, vas deferens, seminal vesicles) from Wolffian duct.

Action of testosterone



II- at puberty:(10-14 years in male or 8-12 years in female)

- Enlargement of testes
- Start of spermatogenesis
- Accessory glands enlarge and start secretion.
- External genitalia enlarge.
- Maintenance of spermatogenesis, reproductive tract.

III- development of sexual libido, maintenance of sex drive in adults.



IV: secondary sexual characters:

Testosterone is responsible for development and maintenance of secondary sexual characters:

- Male pattern of hair growth: beard and chest hair.
- Deep voice due to thickening of vocal cords and enlargement of the larynx.
- Thick skin and sebaceous secretions.
- Male body configuration: broad shoulders, heavy arm and leg musculature.

Action of testosterone



V. Non-reproductive actions:

- 1- protein anabolic.
 - 2- bone growth at puberty(pubertal growth spurt).
 - 3- closure of epiphyseal plates(converted to estrogen).
- Aggressive behaviour.

VI. Negative feedback control of gonadotrophic hormone of anterior pitutary.

Dihydrotestosterone (DHT)

5- α reductase

- Testosterone -----> DHT

Which has the following functions:

1. Differentiation of external genitalia (penis & scrotum) and prostate.
2. Stimulation of hair follicles on face & body.
3. Activity of sebaceous glands.
4. Growth of prostate.
5. Male pattern baldness.

N.B: 5- α reductase inhibitor (Finasteride) is used in treatment of:

6. Benign hypertrophy of the prostate.
7. Hair loss in males.

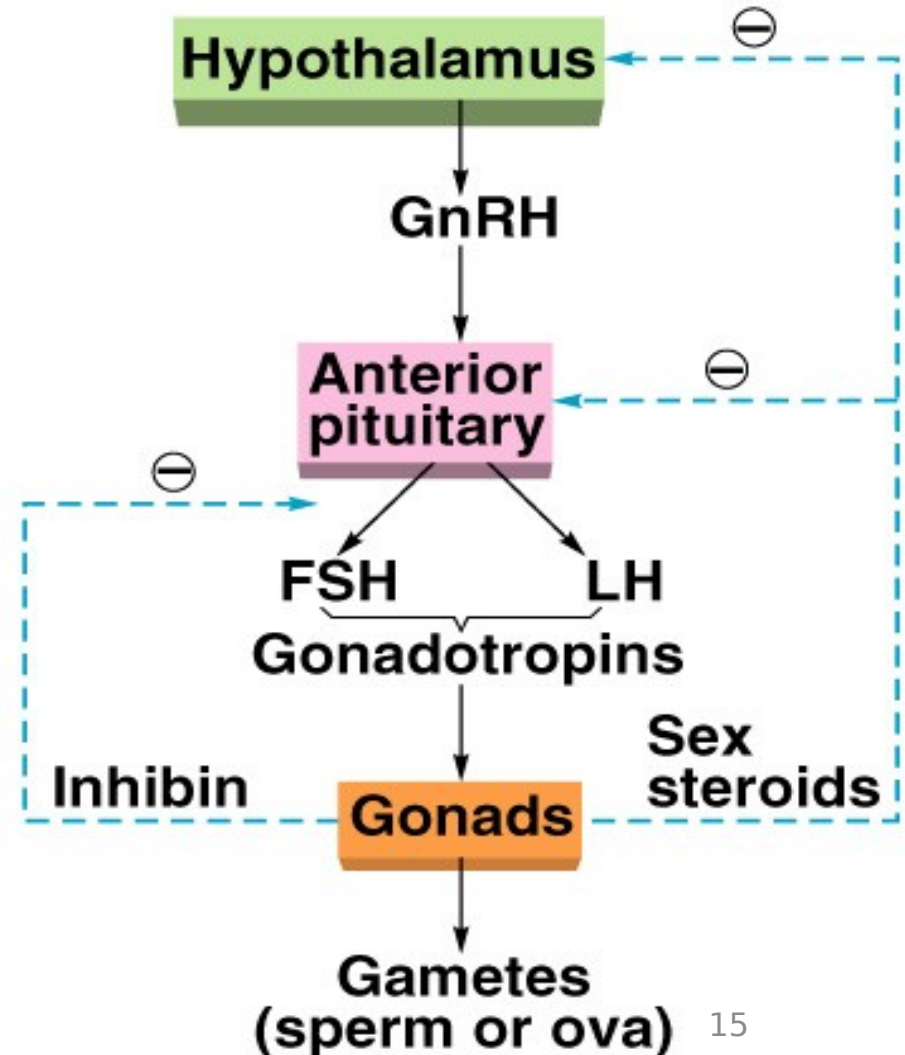
Endocrine Regulation of reproduction



• Negative feedback

Testosterone:

- Inhibits GnRH from hypothalamus.
- Inhibits anterior pituitary response to GnRH.
- Inhibin secretion inhibits anterior pituitary release of FSH.



Estrogen Secretion



- Sertoli cells secrete small amounts of estradiol (testosterone ^{Aromatase} → estrogen).
- May be responsible for:
 - Negative feedback in brain.
 - Sealing of epiphyseal plates.
 - Regulatory function in fertility.



Male Sexual Act

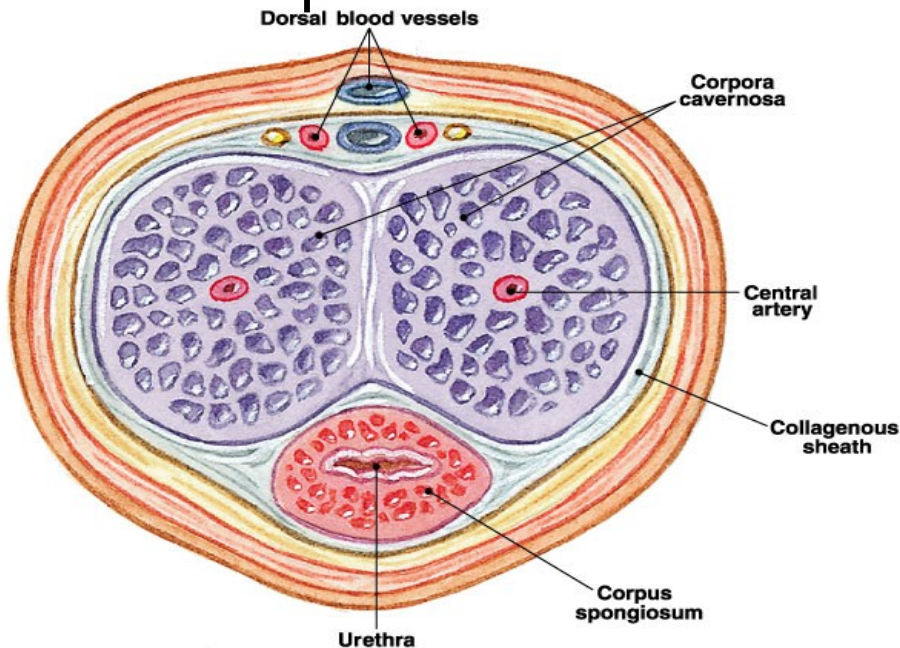
- Physiological process by which semen is introduced to the vagina

- **Erection:**

is the stiffening of the penis due to vascular congestion.

It is a spinal reflex.

- **Sexual excitement (stim.)**



Hardening and elongation of penis

Engorgement of vascular spaces & erectile tissues

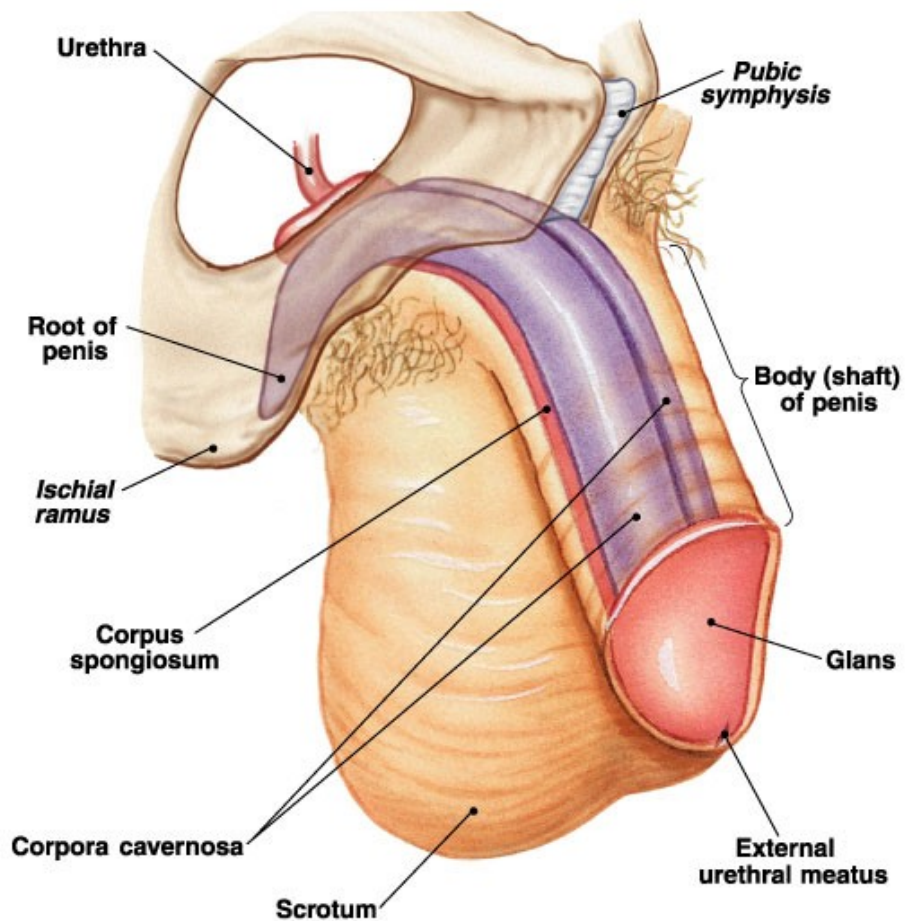
+ parasymp

Acetylcholine
VIP

NO

Dil. Of penile arterioles

Compression of the



- During sexual excitement, a parasympathetic reflex is triggered that causes these arterioles to dilate (NO_2).
- As a result, the vascular spaces of the penis fill with blood causing the penis to become enlarged and rigid.
- Expansion of the penis also compresses the veins retarding the outflow of blood and further contributing to the swelling of the penis.
- This reflex is initiated by a variety of stimuli ranging from thought to touch.

• **Impotence:**
Failure of erection

Ejaculation



- Is a spinal reflex, producing a sympathetic discharge to the genital organs.
- As a result, the reproductive ducts and accessory glands contract discharging their contents into the urethra (emission).

Ejaculation



- The muscles of the penis undergo a rapid series of contractions propelling semen from the urethra (ejaculation proper).
- This is followed by muscular and psychological relaxation and vasoconstriction of the arterioles serving the penis, allowing blood to drain out of the erectile tissue, which subsequently causes the penis to become flaccid again.

**Friction between glans
penis and vagina**



**+ sympath. activity
to smooth m. of
pidid., v.d., s.v., and
prostate**



Ejaculation



**A series of rapid contraction of
urethral smooth m. and skeletal m. of
the base of penis**

Emission

=

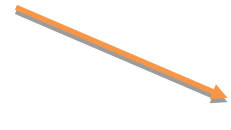
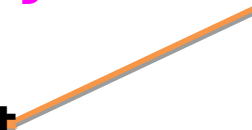
**Discharge of
sperms &
glandular sec to
urethra**



**N.B. during ejaculation the int. urethral sph.
is closed**

**Sperms can not
enter the
bladder**

**Urine can not be
expelled from
bladder**



The entire event is termed an **Orgasm**

Semen



- **Volume:** 2-4 ml/ ejaculate
- **Composition:**
 - 10% sperm
 - 60% seminal vesicle secretion
 - 30% prostate secretion
- **PH:** alkaline
- **Sperm:**
 - Count (60-100)million / ml
 - $< 20 \times 10^6$ sterility (oligosperm)
 - Viable for 72 hr in female tract.
 - Viable for years at -100°C .
 - Abnormal form $< 20\%$.
- **Motility:** 60% after 6 hr of ejaculation.

Abnormalities of testicular function

- **Cryptorchidism** “undescended testis”

- **Hypogonadism** “ testicular function”

1ry

Failure of testicular function



Hypergonadotrophins

+

New five year program

hypogonadism

2ry

Failure of hypoth. &/ant.pit.



Hypogonadotrophins

+

Endocrine & Genitourinary module

hypogonadism

Lecture Quiz



Question 1

Which of the following is a function of Sertoli cells?

- a) Secretion of testosterone
- b) Secretion of FST into tubular lumen
- c) Maintenance of blood- testis barrier
- d) Expression of surface LH receptors
- e) Synthesis of estrogen after puberty

Lecture Quiz



Question 2

Which of the following will lead to an increase in GnRH pulses in the adult male ?


- a) Decrease in free testosterone in plasma despite no change total testosterone
- b) DHT administration
- c) FSH administration
- d) LH administration
- e) Estrogen administration

SUGGESTED TEXTBOOKS



1. Ganong Review of Medical Physiology

25th Edition from page 417 to 426



Thank You

New five year program

Endocrine & Genitourinary module